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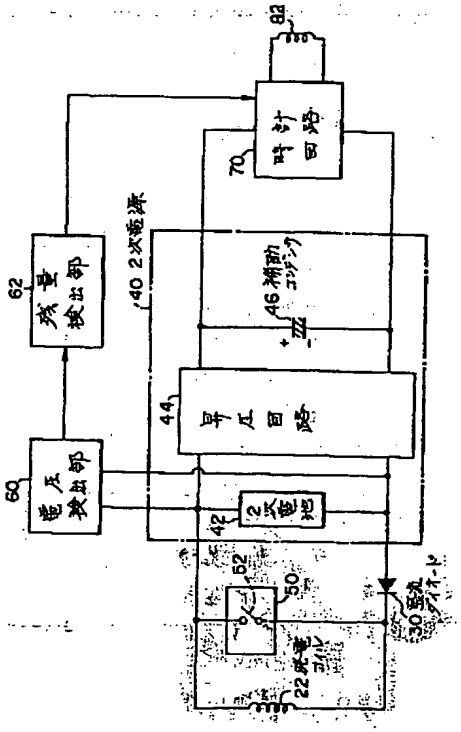
(54)【発明の名称】　電子時計及びその充電方法

(57)【要約】
【目的】　電極に導電性ポリマーを用いた２次電池を急速充電する場合に、２次電池の残量を正確に検出し使用者に知らせることができる電子時計を提供すること。
【構成】　使用者の動作にともなう運動エネルギーを電気エネルギーに変換し、発電コイル２２から充電用出力電圧として出力して化学反応型２次電池４２を充電し、前記２次電池４２の充電エネルギーを用いて時計回路７０が作動し、時刻表示する電子時計である。前記２次電池４２の急速充電動作時に、残量検出部６２は、２次電池の電圧が残量に対応した基準電圧を所定基準時間連続して上回ったとき、残量の検出信号を出力する。



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【特許請求の範囲】

【請求項１】　充電用電気エネルギーを出力する発電手段と、

前記充電用電気エネルギーにより充電される２次電源と、

前記２次電源の充電エネルギーを用いて作動する時計回路と、

前記２次電源の電圧を検出する電圧検出手段と、

前記検出電圧に基づき前記２次電源の残量検出を行う残量検出手段と、

を含み、前記検出残量を知らせ、２次電源の充電を使用者に促す電子時計において、

前記２次電源は、

電極に導電性ポリマーを用いた２次電池を含み、

前記残量検出手段は、

予め２次電池の残量に対応した基準電圧が設定され、前記検出電圧が基準電圧を所定基準時間連続して上回ったとき、前記基準電圧に対応した残量の検出信号を出力するよう形成されたことを特徴とする電子時計。

【請求項２】　請求項１において、

前記残量検出手段は、

予め２次電池の残量に対応した複数の基準電圧が設定され、前記検出電圧が所定基準電圧を所定基準時間連続して上回ったとき、前記基準電圧に対応する残量の検出信号を出力することを特徴とする電子時計。

【請求項３】　請求項２において、

前記残量検出手段は、

前記基準時間を、各基準電圧毎に設定したことを特徴とする電子時計。

【請求項４】　充電用電気エネルギーを出力する発電手段と、

前記充電用電気エネルギーにより充電される２次電源と、

前記２次電源の充電エネルギーを用いて作動する時計回路と、

前記２次電源の電圧を検出する電圧検出手段と、

前記検出電圧に基づき前記２次電源の残量検出を行う残量検出手段と、

を含み、前記検出残量を知らせ、２次電源の充電を使用者に促す電子時計において、

前記発電手段から２次電源への充電を停止させる充電遮断スイッチ手段を含み、

前記２次電源は、

電極に導電性ポリマーを用いた２次電池を含み、

前記残量検出手段は、

前記スイッチ手段により２次電源の充電を一時的に停止し、このときの検出電圧の減衰特性に基づき、２次電池の残量を検出し残量の検出信号を出力するよう形成されたことを特徴とする電子時計。

【請求項５】　充電用電気エネルギーを出力する発電手段と、

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前記充電用電気エネルギーにより充電される２次電源と、

前記２次電源の充電エネルギーを用いて作動する時計回路と、

前記２次電源の残量検出を行う残量検出手段と、

を含み、前記検出残量を知らせ、２次電源の充電を使用者に促す電子時計において、

前記発電手段から２次電源への充電電流を検出する電流検出手段を含み、

前記２次電源は、

電極に導電性ポリマーを用いた２次電池を含み、

前記残量検出手段は、

前記充電電流および充電時間に基づき前記２次電池への充電エネルギーを演算し、この充電エネルギーに基づき２次電池の残量を検出し残量の検出信号を出力するよう形成されたことを特徴とする電子時計。

【請求項６】　電極に導電性ポリマーを用いた２次電池を、充電手段を用いて急速充電する際、前記２次電池の残量を検出する方法において、

前記２次電池の電圧を検出する工程と、

予め２次電池の残量に対応した複数の基準電圧を設定し、前記検出電圧が基準電圧を所定基準時間連続して上回ったとき、前記基準電圧に対応した残量を２次電池の残量として検出する工程と、

を含むことを特徴とする電子時計における２次電池の残量検出方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は発電機構を搭載した電子時計およびその充電方法に関する。

【０００２】

【従来の技術】従来の電子時計では、時計駆動のエネルギー源となる電気は、電池から供給されている。しかし、電池はエネルギーを使い果たすと交換が必要となる。

【０００３】このため、時計駆動に必要な電気エネルギーを生み出す発電機構を搭載した電子時計の開発が行われている。このタイプの電子時計としては、発電機構として太陽電池を用い２次電池を充電するものや、使用者の腕の自然な動き等により発電する自動巻発電機構を搭載して、その出力により２次電池を充電するもの等がある。これらの電子時計は、煩わしい電池交換の必要がないだけでなく、使用済み電池等の廃棄物を生み出すことがないため、省資源、環境保護の観点からも注目されている。

【０００４】通常、このタイプの電子時計には、２次電池の残量を検出し表示する機構が設けられている。そして、２次電池の残りの充電量が、例えば、約３時間、１日、２日、３日等になった場合には、これを検出して使

用者に残量表示を行ない、２次電池の充電を促すようになっている。

【０００５】特に、２次電池の残量が、例えば３時間以下といったように極めて少なくなると、使用者は、２次電池を急速に充電する急速充電動作を行なう必要がある。例えば、充電機構として太陽電池を用いた電池時計は、太陽電池を光源に向けて発電し、２次電池の充電を行なう。また、自動巻発電機構を搭載した電子時計は、時計を振って発電し、２次電池の充電を行なう。このような急速充電動作を、残量表示が所定の値に達するまで行なう。このとき、この充電を確実に行なうためには、２次電池の残量検出を正確に行なうことが必要となる。

【０００６】

【発明が解決しようとする課題】通常、前記２次電池の残量は、その端子電圧を用いて検出される。２次電池として、例えばコンデンサ等を用いた場合には、端子電圧が充電量を正確に反映するため、この端子電圧を見るだけで安定した残量検出が行える。

【０００７】しかし、近年、時計用の２次電池として、電極に導電性ポリマーを用いた２次電池が用いられるようになった。このポリマー電池では、従来の化学電池と異なり、電解液イオンのドーピングを利用して充電および放電を行うため、端子電圧が充電量に応じた電圧に安定するまで、電圧値がふらついて変動するという特性を持っている。したがって、急速充電時に、単にその電圧から残量検出を行なおうとしても、正確な残量を検出できないという問題があった。

【０００８】特に、このタイプの２次電池は、急速充電時に端子電圧が急速に立ち上がり、その後真の充電量に対応した安定電圧に落ち着くという特性を持つ。このため、検出電圧を単に基準電圧と比較して残量検出を行うと、実際の残量より大きい値を誤って表示してしまい、充分な充電がなされない時点で、使用者が急速充電動作を止めてしまうことが多いという問題があった。この場合、電子時計は充電量不足となるため、使用者が知らないうちに時計が停止してしまうというトラブルが発生する。

【０００９】本発明は、このような従来の課題に鑑みてなされたものであり、その目的は、電極に導電性ポリマーを用いた２次電池を急速充電する場合に、その残量を確実に検出し、使用者に知らせることができる電子時計およびその残量検出方法を提供することにある。

【００１０】

【課題を解決するための手段】前記目的を達成するため、請求項１に記載の発明は、充電用電気エネルギーを出力する発電手段と、前記充電用電気エネルギーにより充電される２次電源と、前記２次電源の充電エネルギーを用いて作動する時計回路と、前記２次電源の電圧を検出する電圧検出手段と、前記検出電圧に基づき前記２次電源の残量検出を行う残量検出手段と、を含み、前記検出残量を知らせ、２次電源の充電を使用者に促す電子時計において、前記２次電源は、電極に導電性ポリマーを用いた２次電池を含み、前記残量検出手段は、予め２次電池の残量に対応した基準電圧が設定され、前記検出電圧が基準電圧を所定基準時間連続して上回ったとき、前記基準電圧に対応した残量の検出信号を出力するよう形成され、前記２次電池の急速充電時の残量検出を正確に行うことを特徴としている。

【００１１】請求項２に記載の発明は、請求項１において、前記残量検出手段は、予め２次電池の残量に対応した複数の基準電圧が設定され、前記検出電圧が所定基準電圧を所定基準時間連続して上回ったとき、前記基準電圧に対応する残量の検出信号を出力することを特徴としている。

【００１２】請求項３に記載の発明は、請求項２において、前記残量検出手段は、前記基準時間を、各基準電圧毎に設定したことを特徴としている。

【００１３】請求項４に記載の発明は、充電用電気エネルギーを出力する発電手段と、前記充電用電気エネルギーにより充電される２次電源と、前記２次電源の充電エネルギーを用いて作動する時計回路と、前記２次電源の電圧を検出する電圧検出手段と、前記検出電圧に基づき前記２次電源の残量検出を行う残量検出手段と、を含み、前記検出残量を知らせ、２次電源の充電を使用者に促す電子時計において、前記発電手段から２次電源への充電を停止させる充電遮断スイッチ手段を含み、前記２次電源は、電極に導電性ポリマーを用いた２次電池を含み、前記残量検出手段は、前記スイッチ手段により２次電源の充電を一時的に停止し、このときの検出電圧の減衰特性に基づき、２次電池の残量を検出し残量の検出信号を出力するよう形成され、前記２次電池の急速充電時の残量表示を正確に行うことを特徴としている。

【００１４】請求項５に記載の発明は、充電用電気エネルギーを出力する発電手段と、前記充電用電気エネルギーにより充電される２次電源と、前記２次電源の充電エネルギーを用いて作動する時計回路と、前記２次電源の残量検出を行う残量検出手段と、を含み、前記検出残量を知らせ、２次電源の充電を使用者に促す電子時計において、前記発電手段から２次電源への充電電流を検出する電流検出手段を含み、前記２次電源は、電極に導電性ポリマーを用いた２次電池を含み、前記残量検出手段は、前記検出電圧及び充電電流に基づき前記２次電池への充電エネルギーを演算し、この充電エネルギー及び前記検出電圧に基づき２次電池の残量を検出し残量の検出信号を出力するよう形成され、前記２次電池の急速充電時の残量表示を正確に行うことを特徴としている。

【００１５】請求項６に記載の発明は、電極に導電性ポリマーを用いた２次電池を、充電手段を用いて急速充電する際、前記２次電池の残量を検出する方法において、前記２次電池の電圧を検出する工程と、予め２次電池の

残量に対応した複数の基準電圧を設定し、前記検出電圧が基準電圧を所定基準時間連続して上回ったとき、前記基準電圧に対応した残量を２次電池の残量として検出する工程と、を含み、前記２次電池の急速充電時の残量検出を正確に行うことを特徴としている。

【００１６】

【作用】請求項１の電子時計によれば、２次電源は、発電手段から出力される充電電気エネルギーにより充電される。そして、時計回路は、前記２次電源の充電エネルギーを用いて作動する。

【００１７】残量検出手段は、前記２次電源の電圧に基づき、２次電源の残量を検出して使用者に知らせる。

【００１８】これにより、使用者は、検出残量が少なくなると、その残量が所定レベルに復帰するまで２次電源に対する急速充電動作を行なう。

【００１９】このとき、前記２次電源が、電極に導電性ポリマーを用いた２次電池を含んだ構成である場合、急速充電時の２次電池の電圧は、充電量に対応した電圧に安定するまで時間がかかり、変動する。

【００２０】本発明においては、この２次電池の残量に対応した基準電圧をあらかじめ設定しておき、検出電圧が基準電圧を所定基準時間連続して上回ったときにはじめて、当該２次電池が少なくとも基準電圧に対応した充電量まで充電されたと判断し、残量の検出信号を出力する構成となっている。これにより、２次電池の急速充電時における残量を正確に使用者に知らせることができる。

【００２１】これに加え、請求項２の発明によれば、例えば3時間、１日、２日等といった２次電池の残量に対応して複数の基準電圧を設定し、２次電池の検出電圧が所定基準電圧を所定基準時間連続して上回ったとき、該当する残量の検出信号を出力している。これにより、急速充電時に、２次電池の充電量を多段階にわたって正確に表示することができる。

【００２２】これに加えて、請求項３の発明によれば、前記基準時間を、各基準電圧毎に設定することにより、２次電池の残量検出をより正確に行なうことができる。

【００２３】特に、ポリマー電池の充電時の電圧は、高い電圧になるほど充電効率が悪化する。このため、前記基準時間は、高電圧側の基準時間を長く設定することが好ましい。

【００２４】また、請求項４の発明によれば、発電手段から２次電源への充電を停止させる充電遮断スイッチ手段を含み、急速充電時に２次電源の充電を一時的に停止する。そして、このときの検出電圧の減衰特性に基づき、２次電池の残量を検出するようになっている。

【００２５】すなわち、電極に導電性ポリマーを用いた２次電池では、急速充電を停止すると、真の充電量に対応した電圧までその電圧レベルが減衰という特性を持つ。したがって、このときの減衰特性を検出することにより、２次電池の真の残量を正確に予測することができる。

【００２６】また、請求項５の発明によれば、発電手段から２次電源への充電電流および充電時間に基づき、２次電池への充電エネルギーを演算している。そして、この充電エネルギーに基づき、２次電池の真の残量を検出し、残量の検出信号を出力するように構成されている。

【００２７】このように、２次電池に実際に供給される充電エネルギーを検出することによっても、２次電池の真の充電量を検出し、残量表示を行なうことができる。

【００２８】また、請求項６の発明によれば、請求項１と同様にして、急速充電時における２次電池の残量を正確に検出することが可能な残量検出方法を得ることができる。

【００２９】

【実施例】次に本発明をアナログ表示型の電子腕時計に適用した場合を例に取り詳細に説明する。

【００３０】第１実施例

図２には、実施例の電子時計に用いられる発電手段１０および運針機構６０が示されている。

【００３１】この発電手段１０は、時計ケース内の地板に回動自在に取り付けられた半円形の回転錘１２と、この回転錘１２の回転を増速する輪列機構１４と、この輪列機構１４により発電ロータ１８が回転駆動される発電機１６とを含む。

【００３２】そして、使用者が電子時計を装着し腕を動かすと、回転錘１２が回転し、そのときの運動エネルギーが図中矢印方向の回転運動となる。この回転錘１２の回転は輪列機構１４により約１００倍に増速されて発電ロータ１８に伝達される。そして、Ｎ極およびＳ極の永久磁石から構成された発電ロータ１８の高速回転によって、発電ステータ２０を介して発電コイル２２に鎖交する磁束が変化する。

【００３３】磁束が変化すると、電磁誘導により、発電コイル２２から交流電圧が出力され、この交流電圧が、図１に示す整流ダイオード３０で整流され、２次電池４２を充電する。前記２次電池４２は、昇圧回路４４、補助コンデンサ４６と共に２次電源４０を構成する。

【００３４】前記したように、発電機１６が作動すると、発電コイル２２により２次電池４２が充電されていく。実施例では２次電池４２の電圧が低くて時計の駆動可動電圧に満たないときは、昇圧回路４４により、２次電池４２の電圧を時計駆動可能な高電圧に変換し、補助コンデンサ４６に蓄電する。そして、補助コンデンサ４６を駆動電源として時計回路７０は作動する。

【００３５】このとき時計回路７０は、振動部にクオーツを用いた発振回路の出力を、分周回路を用いて分周し、その分周出力を駆動回路がカウントし、１秒毎に極性の異なる駆動パルスをステップモータ８０の駆動コイル８２へ向け出力する。

【００３６】これにより、図２に示すステップモータ８０は、駆動パルスが通電される毎にロータ８６を回転駆動し、輪列機構９０を介し秒針１０４、分針１０６、時針１０８を駆動し、時刻をアナログ表示する。

【００３７】このような電子時計では、２次電池４２の過充電を防止するため、過充電防止手段として機能するリミッタ回路５０が、前記コイル２０と並列に設けられ、充電回路に対するバイパス回路を形成している。前記リミッタ回路５０は、バイパス回路をオン，オフするスイッチ素子５２を含み、２次電池４２の充電電圧が過充電検出用基準値を上回わると、スイッチ素子５２をオンするように形成されている。これにより、前記２次電池４２に対する充電電流は、このバイパス回路を流れることとなり、２次電池の過充電が防止される。

【００３８】図３には、前記２次電源４０における昇圧動作の概念図が示されている。時計回路７０を駆動させるには、現在のところ最低１ボルトの電圧が必要となる。電気を蓄える２次電池４２は、一般の電池と異なり、充電量に応じて電圧が変化する特性を持っている。充電量が低下して電圧が１ボルトを下回ると、エネルギーそのものはあるものの、電圧が足りないため時計が止まってしまう。なるべく早く時計を始動させ、長く動かし続けるためには、２次電池４２に充電したエネルギーを無駄なく使う必要がある。そこで、２次電池４２の低い状態の電圧を、時計を駆動させるのに必要なレベルの電圧まで昇圧回路４４を用いて昇圧し、コンデンサ４６へ充電している。

【００３９】実施例の昇圧回路４４は、図３に示すよう、充電により２次電池４２の電圧が増加するに従い、これを３倍～１倍の７段階に亘って昇圧し、補助コンデンサ４６を、その電圧が１Ｖ以上となるようへ充電する。同様に、２次電池４２の電圧が放電等により減衰する場合には、昇圧の場合とは逆に、この電圧を１倍～３倍の範囲内で７段階にわたって昇圧し、補助コンデンサ４６へ充電している。

【００４０】また、このような電子時計では、あとどのくらい動き続けるかを使用者に知らせる必要がある。このため、実施例の電子時計は、２次電池４２の現在の充電量、すなわち、時計があとどのくらい動き続けるかの残量を表すインジケータ機能が設けられている。

【００４１】このための残量検出用に、実施例の装置には、２次電池４２の電圧を検出する電圧検出部６０と、この検出電圧に基づき２次電池４２の残量を検出する残量検出部６２とが設けられ、残量検出信号が時計回路７０に向け出力されるよう構成されている。

【００４２】時計回路７０は、図５に示すよう、リューズ右上のボタン９２を押すことにより、運針中の秒針を早送りし、その早送り量で２次電池４２の残量表示を行なうように形成されいている。すなわち、２次電池４２の残量が３日以上ある場合には、３０秒、２日以上ある場合には２０秒、１日以上ある場合には１０秒、３時間以上ある場合には５秒というように秒針を早送りし、その残量表示を行なう。また、残量が３時間以内の場合には、秒針が２秒運針になる機構も備えている。

【００４３】そして、２次電池４２の残量が残り少なくなった場合には、使用者は図５に示すようなインジケータ表示を見ながら、２次電池４２の充電量が所定の基準量、例えば１日分の充電量となるよう２次電池４２に対する急速充電動作を行なう。このような急速充電動作は、図２に示すような発電手段を採用した本実施例の電子時計にあっては、時計本体を振り、回転錘１２を回転させることにより行なう。

【００４４】このような２次電池４２の残量検出は、通常電圧検出部６０で検出された２次電池４２の充電電圧に基づいて行われる。このような検出手法は、２次電池４２がコンデンサ等で構成されている場合には問題がないが、電極に導電性ポリマーを用いた２次電池である場合には、正確な残量検出を行なうことができない。

【００４５】本実施例は、２次電池４２が、このようなポリマー電池である場合に、その残量検出を正確に行なうことを特徴とするものである。

【００４６】図４には、実施例の電子時計に２次電池として用いられるポリマ電池４２の急速充電特性が示されている。このポリマー電池としては、各種のものが知られており、例えばポリアセン電池、Ｌｉ／ＰＡＳ電池、ＰＡＳ－Ｌｉコンポジット／ＰＡＳ電池、ＰＡＳ／ＰＡＳ電池等がある。

【００４７】この種の２次電池４２は、急速充電を行なうと、実際の充電量より端子電圧が大きく現れる。また、２次電池の充電エネルギーを消費すると、その端子電圧は真の充電量に対応した電圧まで急激に低下する傾向を持つ。したがって、急速充電時には、その端子電圧が上下にふらつくという現象が発生する。

【００４８】残量検出部６２は、図５の（Ａ）～（Ｄ）の４つの残量表示に対応して、Ｖａ，Ｖｂ，Ｖｃ，Ｖｄの４つの基準電圧を設定している。

【００４９】従来の残量検出手法では、検出電圧がこの基準電圧を上回った時点で、設定充電量まで充電されたと判断してインジケータ表示を行なうため、正確な残量表示ができなかった。

【００５０】これに対し、実施例の残量検出部６２は、検出電圧が基準電圧を所定基準時間連続して上回ったとき、２次電池４２がその基準電圧に対応した充電量まで充電されたと判断し、残量検出信号を出力するように構成されている。

【００５１】例えば、２次電池４２の残量が０近くなった場合に、急速充電動作を行うと、２次電池４２の検出電圧Ｖｉが図４に示すよう、第１の基準電圧Ｖａを最初に上回るのはｔ１のタイミングである。しかし、この状態では、その直後に電圧Ｖｉが基準電圧Ｖａを下回るた

め、３時間分の充電が行われていないと判断する。そして、検出電圧Ｖｉが基準電圧Ｖａを一定基準時間ｔａの間連続して上回っていることが検出された時点ｔ３ではじめて、残量検出信号を出力する。このようにして、インジケータには、確実に所定の充電量が充電されたことが確認された段階で、当該残量が表示されることになる。この結果、使用者はインジケータの表示を信頼しながら、急速充電を行なうことが可能となる。

【００５２】このとき、前記基準時間は、各基準電圧に対し全て同一に設定してもよいが、本実施例では、各基準電圧Ｖａ，Ｖｂ，Ｖｃ，Ｖｄ毎にそれぞれ固有の値ｔａ，ｔｂ，ｔｃ，ｔｄに設定している。これにより、２次電池の充電レベルに応じてより確実な残量検出を行なうことが可能となる。

【００５３】特に、ポリマー電池の充電時の電圧は、高い電圧になるほど充電効率が悪化する。このため、前記基準時間は、高電圧側の基準時間を長く設定することが好ましい。

【００５４】このため、実施例においては、前記各基準時間が次のように設定される。

ｔａ＝１０秒
ｔｂ＝２０秒
ｔｃ＝４０秒
ｔｄ＝６０秒

なお、図４は、本発明の原理を概括的に説明するための模式的に描いてある。したがって、実際のｔ３～ｔ４、ｔ６～ｔ７、ｔ８～ｔ９の間隔は、図に示すより十分に長くなる。

【００５５】第２実施例

図６には、本発明の電子時計の好適な第２実施例が示されている。なお、前記第１実施例と対応する部材には同一符号を付してその説明は省略する。

【００５６】本実施例の電子時計では、発電コイル２２から２次電池４２へ向けた充電回路に充電遮断スイッチ６４を設けている。そして、残量検出部６２は、２次電池４２の残量検出を行なう場合、所定の短時間だけスイッチ６４をオフし、２次電池４２の充電を強制的に停止させる。

【００５７】このとき、電圧検出部６０で検出される２次電池４２の検出電圧Ｖｉは、図７に示すように変化する。すなわち、急速充電時に、ｔａのタイミングでスイッチ６４をオフし充電を停止させると、２次電池４２の端子電圧Ｖｉは、真の充電量に対応した安定電圧に向けて減衰を開始する。

【００５８】ポリマー電池の特性として、充電を停止してから一定時間経過後の電圧低下が大きい程、実際の充電量は少ないと判断できる。

【００５９】残量検出部６２は、このような２次電池４２の減衰特性と、検出電圧Ｖｉとから、充電量に対応した２次電池の安定電圧を推定演算し、これを各基準電圧Ｖａ～Ｖｄと比較する。そして、推定演算された電圧が、いずれかの基準電圧を上回った場合には、当該基準電圧に対応した残量検出信号を時計回路７０へ向け出力する。

【００６０】このようにすることによっても、ポリマー電池４２の急速充電時における残量検出を正確に行なうことができる。

【００６１】第３実施例

図８には、本発明の電子時計の好適な第３実施例が示されている。

【００６２】実施例の電子時計では、発電コイル２２から２次電池４２へ向けた充電回路に充電電流を検出する電流計６６が設けられ、その検出値が残量検出部６２へ向け出力されている。

【００６３】残量検出部６２は、検出された充電電流と、充電時間とに基づき、２次電池４２への充電エネルギーを演算する。そして、充電エネルギーに基づき検出電圧を補正演算し、補正された検出電圧を前記第２実施例と同様に各基準電圧Ｖａ～Ｖｄと比較する。そして、補正検出電圧が、いずれかの基準電圧を上回った際、該当する残量の検出信号を時計回路７０へ向け出力する。

【００６４】このように、実施例の残量演算部６２は、演算された充電エネルギーから２次電池４２の検出電圧の上昇分を補正し、充電量に対応した電圧を推定演算している。このようにすることによっても、ポリマー電池４２の急速充電時における残量表示を正確に行なうことができる。

【００６５】また、予め充電エネルギーと電圧との相関関係をテーブル化して残量演算部６２に記憶しておくことにより、前記電圧検出部６２を用いることなく、充電電流と充電時間とから求まる充電エネルギーから充電電圧を推定できる。

【００６６】なお、本発明は前記各実施例に限定されるものではなく、本発明の要旨の範囲内で各種の変形実施が可能である。

【００６７】例えば、前記各実施例では、発電手段として図２に示すような発電機１６および回転錘１２を用いたものを例に取り説明したが、本発明はこれに限らず、各種の発電手段、例えば太陽電池等を用いた電子時計に対しても適用可能であることはいうまでもない。

【００６８】また、前記実施例では、残量表示するインジケータとして、アナログ表示用の秒針を用いる場合を例に取り説明したが、本発明はこれ以外に、例えば、液晶表示タイプの電子時計では、液晶ディスプレイ上に残量表示するようにしてもよい。

【００６９】また、必要に応じ、音声出力用のＩＣを設け、残量を音声出力させてもよい。

【００７０】また、前記実施例では、本発明を腕時計に適用した場合を例に取り説明したが、本発明はこれに限らずこれ以外の各種時計、例えば携帯用時計等にも適用

可能であることはいうまでもない。

【００７１】

【発明の効果】以上説明したように、本発明によれば、電極に導電性ポリマーを用いた２次電池を急速充電する場合に、２次電池の残量を正確に検出し使用者に知らせることができる電子時計およびその残量検出方法を提供することができる。

【図面の簡単な説明】

【図１】本発明の電子時計の第１実施例の回路図である。

【図２】実施例の電子時計の機械的な構成の要部を示す説明図である。

【図３】実施例の電子時計の昇圧回路の動作を示す説明図である。

【図４】電極に導電性ポリマーを用いた２次電池の急速充電時における充電特性の説明図である。

【図５】残量表示の具体例の説明図である。

【図６】本発明の電子時計の第２実施例の回路図である。

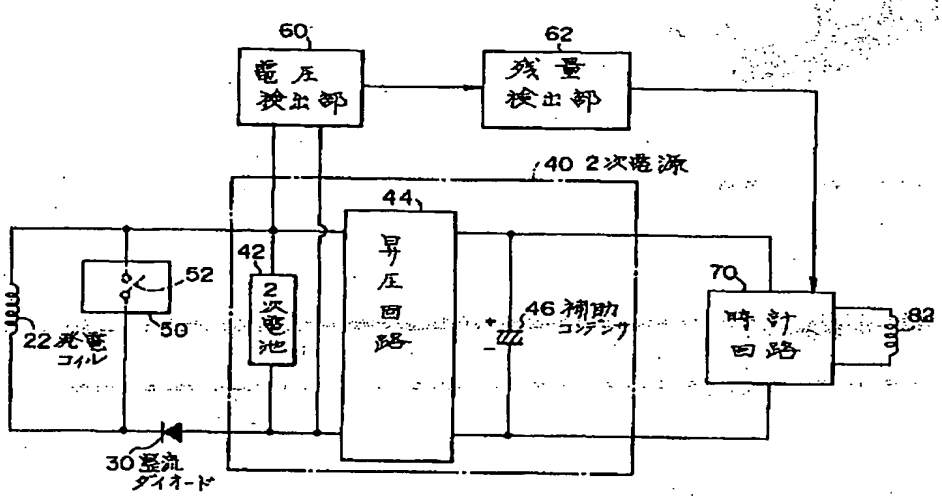
【図７】第２実施例にかかる電子時計の残量検出の原理の概略説明図である。

【図８】本発明の第３実施例にかかる電子時計の回路図である。

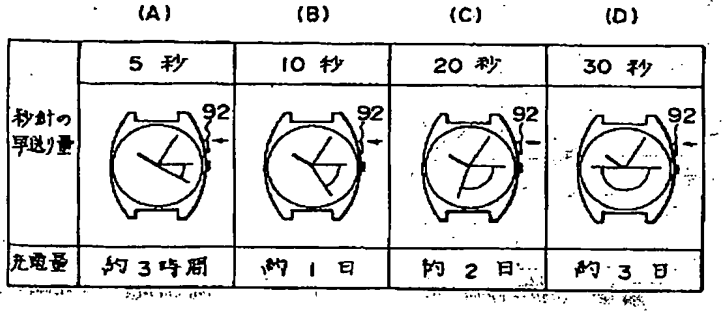
【符号の説明】

１０　発電手段
４０　２次電源
４２　２次電池
４４　昇圧回路
４６　補助コンデンサ
６０　電圧検出部
６２　残量検出部
６６　電流計
７０　時計回路

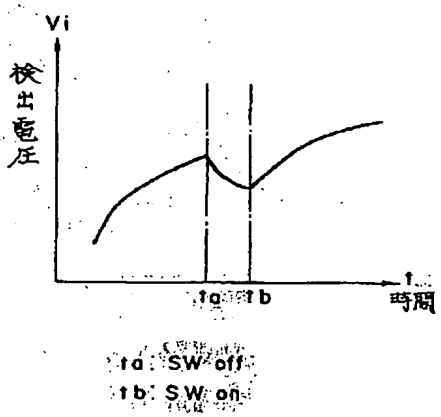
【図１】



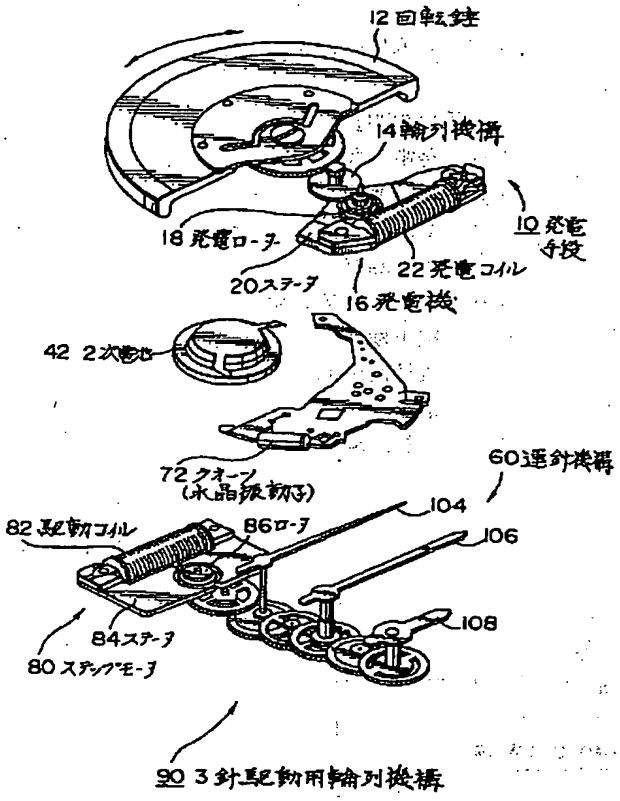
【図５】



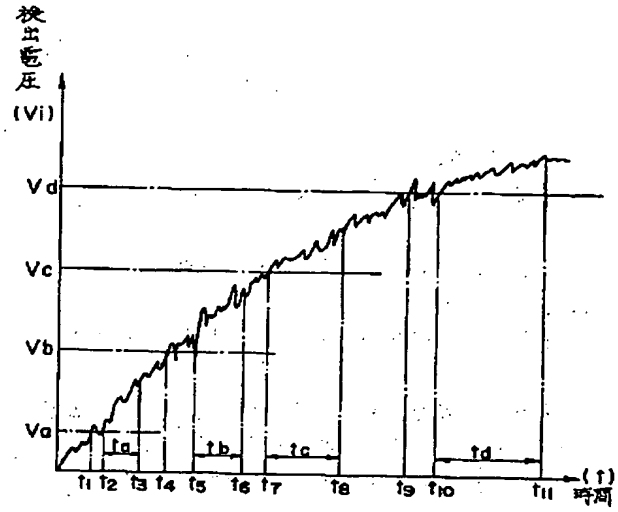
【図７】



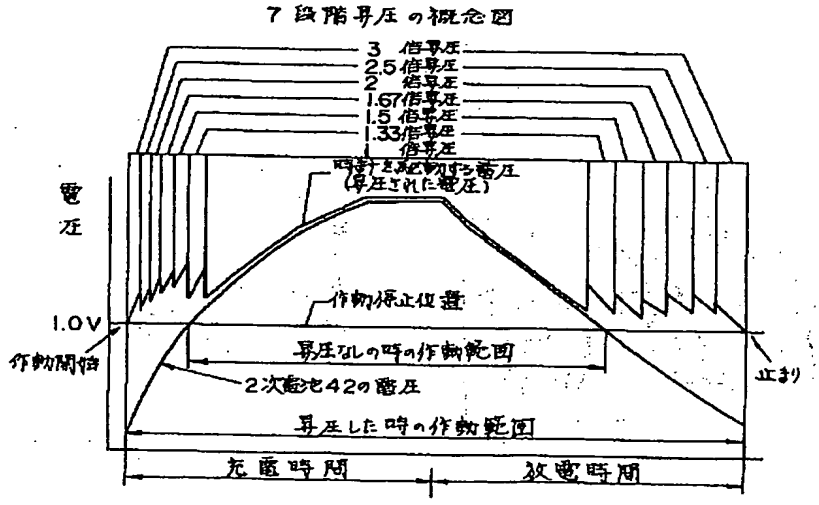
【図２】


12 回転錘
14 輪列機構
10 発電子機
18 発電ロータ
20 ステータ
22 発電コイル
16 発電機
42 2次電池
72 クオーツ（水晶振動子）
60 運針機構
104
106
82 駆動コイル
86 ロータ
108
84 ステータ
80 ステップモータ
90 3針駆動用輪列機構

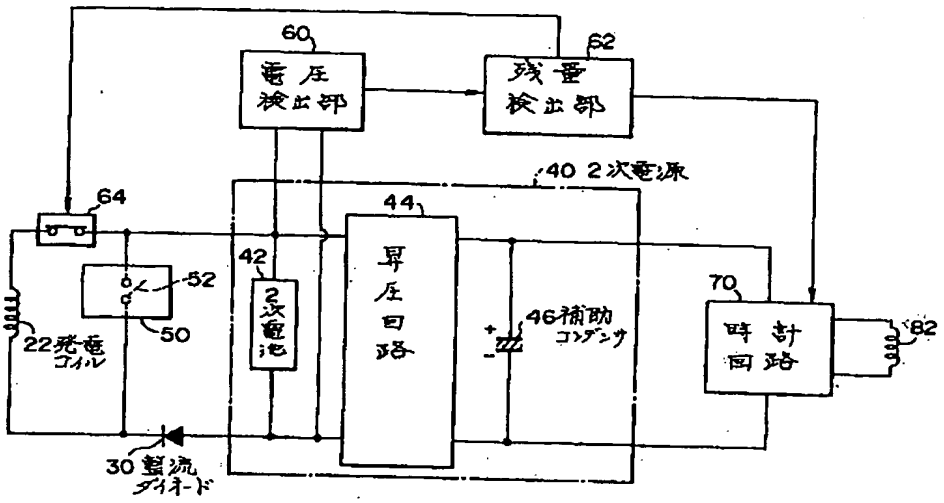
【図４】


検出電圧 (Vi)
Vd
Vc
Vb
Va
ta
tb
tc
td
t1 t2 t3 t4 t5 t6 t7 t8 t9 t10 t11
(t) 時間

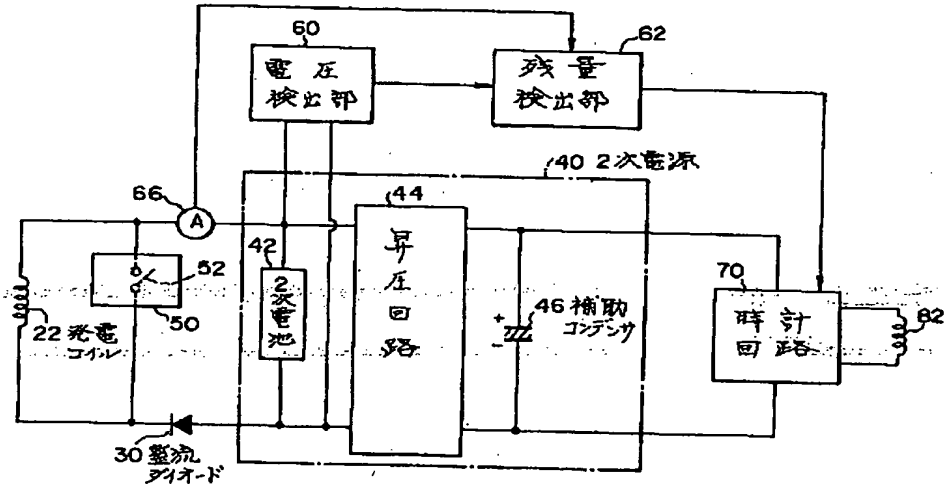
【図３】


7 段階昇圧の概念図
3 倍昇圧
2.5 倍昇圧
2 倍昇圧
1.67 倍昇圧
1.5 倍昇圧
1.33 倍昇圧
1 倍昇圧
時計を正常に動かす電圧
(昇圧された電圧)
電圧
作動保証位置
1.0V
作動開始
昇圧なしの時の作動範囲
止まり
2次電池42の電圧
昇圧した時の作動範囲
充電時間
放電時間

【図６】


60
電圧検出部
62
残量検出部
40 2次電源
64
44
昇圧回路
42
2次電池
52
50
22発電コイル
46補助コンデンサ
70
時計回路
82
30整流ダイオード

【図８】


60
電圧検出部
62
残量検出部
40 2次電源
66
A
44
昇圧回路
42
2次電池
52
50
22発電コイル
46補助コンデンサ
70
時計回路
82
30整流ダイオード

【公報種別】特許法第１７条の２の規定による補正の掲載
【部門区分】第６部門第１区分
【発行日】平成１０年（１９９８）１１月４日

【公開番号】特開平７―３０６２７５
【公開日】平成７年（１９９５）１１月２１日
【年通号数】公開特許公報７―３０６３
【出願番号】特願平６―１２４１４４
【国際特許分類第６版】
G04C 10/04
3/14
G04G 1/00 310
【ＦＩ】
G04C 10/04 C
3/14 Q
G04G 1/00 310 F

【手続補正書】
【提出日】平成９年３月２５日
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】特許請求の範囲
【補正方法】変更
【補正内容】
【特許請求の範囲】
【請求項１】　充電用電気エネルギーを出力する発電手段と、
前記充電用電気エネルギーにより充電される２次電源と、
前記２次電源の充電エネルギーを用いて作動する時計回路と、
前記２次電源の電圧を検出する電圧検出手段と、
前記電圧検出手段により検出した検出電圧に基づき前記２次電源の残量検出を行う残量検出手段と、
を含み、前記残量検出手段により検出した検出残量を知らせ、２次電源の充電を使用者に促す電子時計において、
前記２次電源は、
電極に導電性ポリマーを用いた２次電池を含み、
前記残量検出手段は、
予め前記２次電池の残量に対応した基準電圧が設定され、前記検出電圧が前記基準電圧を所定基準時間連続して上回ったとき、前記基準電圧に対応した前記２次電池の残量の検出信号を出力するよう形成されたことを特徴とする電子時計。
【請求項２】　請求項１において、
前記残量検出手段は、
予め前記２次電池の残量に対応した複数の基準電圧が設定され、前記検出電圧が所定の前記基準電圧を所定基準時間連続して上回ったとき、前記基準電圧に対応した前記２次電池の残量の検出信号を出力することを特徴とする電子時計。
【請求項３】　請求項２において、
前記残量検出手段は、
前記基準時間を、各前記基準電圧毎に設定したことを特徴とする電子時計。
【請求項４】　充電用電気エネルギーを出力する発電手段と、
前記充電用電気エネルギーにより充電される２次電源と、
前記２次電源の充電エネルギーを用いて作動する時計回路と、
前記２次電源の電圧を検出する電圧検出手段と、
前記電圧検出手段により検出した検出電圧に基づき前記２次電源の残量検出を行う残量検出手段と、
を含み、前記残量検出手段により検出した検出残量を知らせ、２次電源の充電を使用者に促す電子時計において、
前記発電手段から前記２次電源への充電を停止させる充電遮断スイッチ手段を含み、
前記２次電源は、
電極に導電性ポリマーを用いた２次電池を含み、
前記残量検出手段は、
前記スイッチ手段により前記２次電源の充電を一時的に停止し、このときの前記検出電圧の減衰特性に基づき、前記２次電池の残量を検出し残量の検出信号を出力するよう形成されたことを特徴とする電子時計。
【請求項５】　充電用電気エネルギーを出力する発電手段と、
前記充電用電気エネルギーにより充電される２次電源と、
前記２次電源の充電エネルギーを用いて作動する時計回

路と、
前記２次電源の電圧を検出する電圧検出手段と、
前記電圧検出手段により検出した検出電圧に基づき前記２次電源の残量検出を行う残量検出手段と、
を含み、前記残量検出手段により検出した検出残量を知らせ、前記２次電源の充電を使用者に促す電子時計において、
前記発電手段から前記２次電源への充電電流を検出する電流検出手段を含み、
前記２次電源は、
電極に導電性ポリマーを用いた２次電池を含み、
前記残量検出手段は、
前記充電電流および充電時間に基づき前記２次電池への充電エネルギーを演算し、この充電エネルギーに基づき前記２次電池の残量を検出し残量の検出信号を出力するよう形成されたことを特徴とする電子時計。

【請求項６】　電極に導電性ポリマーを用いた２次電池を、充電手段を用いて急速充電する際、前記２次電池の残量を検出する方法において、
前記２次電池の電圧を検出する工程と、
予め前記２次電池の残量に対応した複数の基準電圧を設定し、検出した電圧が前記基準電圧を所定基準時間連続して上回ったとき、前記基準電圧に対応した残量を２次電池の残量として検出する工程と、
を含むことを特徴とする電子時計における２次電池の残量検出方法。

PATENT ABSTRACTS OF JAPAN

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G04C 3/14
G04G 1/00

(21)Application number : 06-124144

(22)Date of filing : 13.05.1994

(71)Applicant : SEIKO EPSON CORP

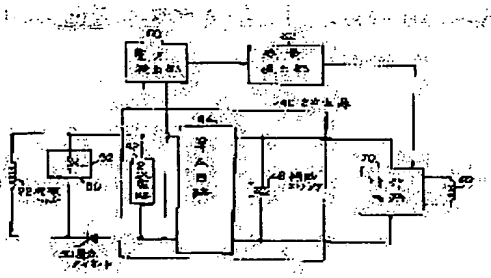
(72)Inventor : KITAHARA JOJI
OSHIMA YASUHIRO

(54) ELECTRONIC CLOCK AND CHARGING METHOD THEREFOR

(57)Abstract:

PURPOSE: To provide an electronic clock in which the residual capacity of a secondary battery can be detected accurately to notify a user, at the time of boosting charge of the secondary battery employing an electrode of conductive polymer.

CONSTITUTION: This in an electronic clock, in which kinetic energy accompanying the motion of a user is converted into electric energy and taken out, from a generating coil 22, in the form of an output voltage for charging a chemical reaction secondary battery 42. Charging energy from the secondary battery 42 is employed in a clock circuit 70 for displaying the time. In such electronic clock, a residual capacity detecting section 62 outputs a residual capacity detection signal when the voltage of the secondary battery 42 exceeds a reference voltage corresponding to the residual capacity continuously for a predetermined reference time at the time of boosting charge of the secondary battery 42.



LEGAL STATUS

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[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 2973273

[Date of registration] 03.09.1999

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] A generation-of-electrical-energy means to output the electrical energy for charge, and the secondary power source charged by said electrical energy for charge, The clock circuit which operates using the charge energy of said secondary power source, and an electrical-potential-difference detection means to detect the electrical potential difference of said secondary power source, In the electronic clock which tells said detection residue and demands charge of a secondary power source from a user including a residue detection means to perform residue detection of said secondary power source based on said detection electrical potential difference said secondary power source The rechargeable battery which used the conductive polymer for the electrode is included. Said residue detection means The electronic clock characterized by being formed so that the detecting signal of the residue corresponding to said reference voltage may be outputted when the reference voltage corresponding to the residue of a rechargeable battery was set up beforehand, and said detection electrical potential difference carries out predetermined conventional-time continuation and exceeds reference voltage.
[Claim 2] It is the electronic clock characterized by outputting the detecting signal of the residue corresponding to said reference voltage when two or more reference voltages which were equivalent to the residue of a rechargeable battery beforehand are set up, as for said residue detection means, said detection electrical potential difference carries out predetermined conventional-time continuation of the predetermined reference voltage in claim 1 and it exceeds.
[Claim 3] It is the electronic clock characterized by said residue detection means setting up said conventional time for every reference voltage in claim 2.
[Claim 4] A generation-of-electrical-energy means to output the electrical energy for charge, and the secondary power source charged by said electrical energy for charge, The clock circuit which operates using the charge energy of said secondary power source, and an electrical-potential-difference detection means to detect the electrical potential difference of said secondary power source, In the electronic clock which tells said detection residue and demands charge of a secondary power source from a user including a residue detection means to perform residue detection of said secondary power source based on said detection electrical potential difference The charge cutoff switching means which stops the charge to a secondary power source from said generation-of-electrical-energy means is included. Said secondary power source The rechargeable battery which used the conductive polymer for the electrode is included. Said residue detection means The electronic clock characterized by being formed so that charge of a secondary power source may be temporarily suspended by said switching means, the residue of a rechargeable battery may be detected based on the damping property of the detection electrical potential difference at this time and the detecting signal of a residue may be outputted.
[Claim 5] A generation-of-electrical-energy means to output the electrical energy for charge, and the secondary power source charged by said electrical energy for charge, In the electronic clock which tells said detection residue and demands charge of a secondary power source from a user including the clock circuit which operates using the charge energy of said secondary power source, and a residue detection

means to perform residue detection of said secondary power source A current detection means to detect the charging current from said generation-of-electrical-energy means to a secondary power source is included. Said secondary power source The rechargeable battery which used the conductive polymer for the electrode is included. Said residue detection means The electronic clock characterized by being formed so that the charge energy to said rechargeable battery may be calculated based on said charging current and charging time, the residue of a rechargeable battery may be detected based on this charge energy and the detecting signal of a residue may be outputted.
[Claim 6] In the approach of detecting the residue of said rechargeable battery in case boosting charge of the rechargeable battery which used the conductive polymer is carried out to an electrode using a charge means When the process which detects the electrical potential difference of said rechargeable battery, and two or more reference voltages which were equivalent to the residue of a rechargeable battery beforehand were set up, and said detection electrical potential difference carries out predetermined conventional-time continuation and exceeds reference voltage, The residue detection approach of the rechargeable battery in the electronic clock characterized by including the process which detects the residue corresponding to said reference voltage as a residue of a rechargeable battery.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the electronic clock which carried the generator style, and its charge approach.
[0002]
[Description of the Prior Art] In the conventional electronic clock, the electrical and electric equipment used as the energy source of a clock drive is supplied from the cell. However, exchange is needed when a cell uses up energy.
[0003] For this reason, development of the electronic clock which carried the generator style which produces electrical energy required for a clock drive is performed. The automatic volume generator style generated by what charges a rechargeable battery as this type of an electronic clock, using a solar battery as a generator style, natural motion of a user's arm, etc. is carried, and there are some which charge a rechargeable battery with that output. There is not only no need for a troublesome changing battery, but these electronic clocks attract attention also from a viewpoint of saving resources and environmental protection in order not to produce trash, such as a used cell.
[0004] Usually, the device which detects and displays the residue of a rechargeable battery on this type of electronic clock is established. And when the remaining charges of a rechargeable battery become on

about 3 hours, one day, the 2nd, the 3rd, etc., this is detected, a residue display is given to a user and charge of a rechargeable battery is urged.

[0005] If the residue of a rechargeable battery decreases extremely especially as it was called 3 or less hours, a user needs to perform boosting-charge actuation which charges a rechargeable battery quickly. For example, the battery-run clock using the solar battery as a charge device turns and generates a solar battery to the light source, and charges a rechargeable battery. Moreover, the electronic clock which carried the automatic volume generator style shakes and generates a clock, and charges a rechargeable battery. Such boosting-charge actuation is performed until a residue display reaches a predetermined value. In order to ensure this charge at this time, it is necessary to perform residue detection of a rechargeable battery correctly.

[0006]

[Problem(s) to be Solved by the Invention] Usually, the residue of said rechargeable battery is detected using the terminal voltage. Since terminal voltage reflects a charge correctly as a rechargeable battery when a capacitor etc. is used, residue detection stabilized only by seeing this terminal voltage can be performed.

[0007] However, the rechargeable battery which used the conductive polymer for the electrode came to be used as a rechargeable battery for clocks in recent years. In this polymer battery, the electrical-potential-difference value has the property of it being unsteady and changing until terminal voltage is stabilized on the electrical potential difference according to a charge, in order to perform charge and discharge using doping of electrolytic-solution ion unlike the conventional chemical cell. Therefore, at the time of boosting charge, even if it was only going to perform residue detection from the electrical potential difference, there was a problem that an exact residue was undetectable.

[0008] Terminal voltage starts quickly at the time of boosting charge, and this type of especially rechargeable battery has the property of settling in the stabilization electrical potential difference corresponding to the charge of after that truth. For this reason, when the detection electrical potential difference was displayed accidentally [value / than an actual residue / larger] when residue detection was performed [only / reference voltage], and sufficient charge was not made, there was a problem that a user stopped boosting-charge actuation in many cases. In this case, since an electronic clock becomes insufficient [a charge], before a user knows, the trouble where a clock will stop generates it.

[0009] This invention is made in view of such a conventional technical problem, and when carrying out boosting charge of the rechargeable battery which used the conductive polymer for the electrode, the purpose detects the residue certainly and is to offer the electronic clock about which a user can be told, and its residue detection approach.

[0010]

[Means for Solving the Problem] In order to attain said purpose, invention according to claim 1 A generation-of-electrical-energy means to output the electrical energy for charge, and the secondary power source charged by said electrical energy for charge, The clock circuit which operates using the charge energy of said secondary power source, and an electrical-potential-difference detection means to detect the electrical potential difference of said secondary power source, In the electronic clock which tells said detection residue and demands charge of a secondary power source from a user including a residue detection means to perform residue detection of said secondary power source based on said detection electrical potential difference said secondary power source The rechargeable battery which used the conductive polymer for the electrode is included. Said residue detection means The reference voltage corresponding to the residue of a rechargeable battery is set up beforehand, it is formed so that the detecting signal of the residue corresponding to said reference voltage may be outputted, when said detection electrical potential difference carries out predetermined conventional-time continuation and exceeds reference voltage, and it is characterized by performing correctly residue detection at the time of the boosting charge of said rechargeable battery.

[0011] In claim 1, when two or more reference voltages which were equivalent to the residue of a

rechargeable battery beforehand are set up, said detection electrical potential difference carries out predetermined conventional-time continuation of the predetermined reference voltage and said residue detection means exceeds invention according to claim 2, it is characterized by outputting the detecting signal of the residue corresponding to said reference voltage.

[0012] Invention according to claim 3 is characterized by said residue detection means setting up said conventional time for every reference voltage in claim 2.

[0013] A generation-of-electrical-energy means by which invention according to claim 4 outputs the electrical energy for charge, The secondary power source charged by said electrical energy for charge, and the clock circuit which operates using the charge energy of said secondary power source, In the electronic clock which tells said detection residue and demands charge of a secondary power source from a user including an electrical-potential-difference detection means to detect the electrical potential difference of said secondary power source, and a residue detection means to perform residue detection of said secondary power source based on said detection electrical potential difference The charge cutoff switching means which stops the charge to a secondary power source from said generation-of-electrical-energy means is included. Said secondary power source The rechargeable battery which used the conductive polymer for the electrode is included. Said residue detection means Charge of a secondary power source is temporarily suspended by said switching means, it is formed so that the residue of a rechargeable battery may be detected and the detecting signal of a residue may be outputted based on the damping property of the detection electrical potential difference at this time, and it is characterized by performing correctly the residue display at the time of the boosting charge of said rechargeable battery.

[0014] A generation-of-electrical-energy means by which invention according to claim 5 outputs the electrical energy for charge, The secondary power source charged by said electrical energy for charge, and the clock circuit which operates using the charge energy of said secondary power source, In the electronic clock which tells said detection residue and demands charge of a secondary power source from a user including a residue detection means to perform residue detection of said secondary power source A current detection means to detect the charging current from said generation-of-electrical-energy means to a secondary power source is included. Said secondary power source The rechargeable battery which used the conductive polymer for the electrode is included. Said residue detection means Based on said detection electrical potential difference and charging current, the charge energy to said rechargeable battery is calculated. It is formed so that the residue of a rechargeable battery may be detected based on this charge energy and said detection electrical potential difference and the detecting signal of a residue may be outputted, and it is characterized by performing correctly the residue display at the time of the boosting charge of said rechargeable battery.

[0015] In the approach of detecting the residue of said rechargeable battery in case invention according to claim 6 carries out boosting charge of the rechargeable battery which used the conductive polymer to an electrode using a charge means When the process which detects the electrical potential difference of said rechargeable battery, and two or more reference voltages which were equivalent to the residue of a rechargeable battery beforehand were set up, and said detection electrical potential difference carries out predetermined conventional-time continuation and exceeds reference voltage, It is characterized by performing correctly residue detection at the time of the boosting charge of said rechargeable battery including the process which detects the residue corresponding to said reference voltage as a residue of a rechargeable battery.

[0016]

[Function] According to the electronic clock of claim 1, a secondary power source is charged by the charge electrical energy outputted from a generation-of-electrical-energy means. And a clock circuit operates using the charge energy of said secondary power source.

[0017] Based on the electrical potential difference of said secondary power source, a residue detection means detects the residue of a secondary power source, and tells a user about it.

[0018] Thereby, if a detection residue decreases, a user will perform boosting-charge actuation to a secondary power source until the residue returns to predetermined level.
[0019] When it is the configuration that said secondary power source contained the rechargeable battery which used the conductive polymer for the electrode at this time, time amount is taken and the electrical potential difference of the rechargeable battery at the time of boosting charge is changed until it is stabilized on the electrical potential difference corresponding to a charge.
[0020] In this invention, the reference voltage corresponding to the residue of this rechargeable battery is set up beforehand, and when a detection electrical potential difference carries out predetermined conventional-time continuation and exceeds reference voltage, for the first time, the rechargeable battery concerned judges that it charged to the charge corresponding to reference voltage at least, and has composition which outputs the detecting signal of a residue. Thereby, a user can be correctly told about the residue at the time of the boosting charge of a rechargeable battery.
[0021] In addition, according to invention of claim 2, two or more reference voltages are set up, for example corresponding to the residue of rechargeable batteries, such as 3 hours, one day, and two etc. days, and when the detection electrical potential difference of a rechargeable battery carries out predetermined conventional-time continuation and exceeds predetermined reference voltage, the detecting signal of the corresponding residue is outputted. Thereby, the charge of a rechargeable battery can be correctly displayed over a multistage story at the time of boosting charge.
[0022] In addition, according to invention of claim 3, residue detection of a rechargeable battery can be more correctly performed by setting up said conventional time for every reference voltage.
[0023] Charging efficiency gets worse, so that especially the electrical potential difference at the time of charge of a polymer battery turns into a high electrical potential difference. For this reason, as for said conventional time, it is desirable to set up the conventional time by the side of the high voltage for a long time.
[0024] Moreover, according to invention of claim 4, charge of a secondary power source is temporarily suspended including the charge cutoff switching means which stops the charge to a secondary power source from a generation-of-electrical-energy means at the time of boosting charge. And the residue of a rechargeable battery is detected based on the damping property of the detection electrical potential difference at this time.
[0025] That is, in the rechargeable battery which used the conductive polymer for the electrode, when boosting charge is suspended, the voltage level has the property of attenuation to the electrical potential difference corresponding to a true charge. Therefore, the true residue of a rechargeable battery can be correctly predicted by detecting the damping property at this time.
[0026] Moreover, according to invention of claim 5, the charge energy to a rechargeable battery is calculated based on the charging current and the charging time from a generation-of-electrical-energy means to a secondary power source. And based on this charge energy, the true residue of a rechargeable battery is detected, and it is constituted so that the detecting signal of a residue may be outputted.
[0027] Thus, also by detecting the charge energy actually supplied to a rechargeable battery, the true charge of a rechargeable battery can be detected and a residue display can be performed.
[0028] Moreover, according to invention of claim 6, the residue detection approach like claim 1 which can detect correctly the residue of the rechargeable battery at the time of boosting charge can be acquired.
[0029]
[Example] Next, this invention is explained to a detail taking the case of the case where it applies to the electronic wrist watch of an analog-display mold.
[0030] The generation-of-electrical-energy means 10 used for the electronic clock of an example and the movement device 60 are shown in 1st example drawing 2 .
[0031] This generation-of-electrical-energy means 10 contains the rotation spindle 12 of a hemicycle

attached in the cope plate within clock housing free [rotation], the wheel train device 14 in which rotation of this rotation spindle 12 is accelerated, and the generator 16, with which the rotation drive of generation-of-electrical-energy Rota 18 is carried out by this wheel train device 14.

[0032] And if a user carries an electronic clock and moves an arm, the rotation spindle 12 will rotate and the kinetic energy at that time will serve as rotation of the drawing Nakaya mark direction. It accelerates rotation of this rotation spindle 12 about 100 times according to the wheel train device 14, and it is transmitted to generation-of-electrical-energy Rota 18. And the magnetic flux interlinked to a magneto coil 22 through the generation-of-electrical-energy stator 20 by high-speed rotation of generation-of-electrical-energy Rota 18 which consisted of permanent magnets of N pole and the south pole changes.

[0033] If magnetic flux changes, alternating voltage will be outputted by electromagnetic induction from a magneto coil 22, this alternating voltage will be rectified by the rectifier diode 30 shown in drawing 1 , and a rechargeable battery 42 will be charged. Said rechargeable battery 42 constitutes the secondary power source 40 with a booster circuit 44 and the auxiliary capacitor 46.

[0034] If a generator 16 operates as described above, the rechargeable battery 42 is charged with the magneto coil 22. When the electrical potential difference of a rechargeable battery 42 is low and does not fulfill the drive movable electrical potential difference of a clock with an example, by the booster circuit 44, it changes into the high voltage which can clock drive the electrical potential difference of a rechargeable battery 42, and the auxiliary capacitor 46 is stored electricity. And the clock circuit 70 operates by using the auxiliary capacitor 46 as a drive power source.

[0035] At this time, dividing of the output of the oscillator circuit which used the quartz watch is carried out to the oscillating section using a frequency divider, a drive circuit counts that dividing output, and the clock circuit 70 turns and outputs the driving pulse from which a polarity differs for every second to the drive coil 82 of a step motor 80.

[0036] Thereby, whenever a driving pulse energizes the step motor 80 shown in drawing 2 , it carries out the rotation drive of Rota 86, drives the second hand 104, the minute hand 106, and a hour hand 108 through the wheel train device 90, and carries out the analog display of the time of day.

[0037] In such an electronic clock, in order to prevent overcharge of a rechargeable battery 42, the limiter circuit 50 which functions as a overcharge prevention means is established in said coil 20 and juxtaposition, and forms the bypass circuit to a charge circuit. Including the switching device 52 which said limiter circuit 50 turns on a bypass circuit, and is turned off, in the reference value for overcharge detection, the charge electrical potential difference of a rechargeable battery 42 is formed so that a switching device 52 may be turned on with upper ******. Thereby, the charging current over said rechargeable battery 42 will flow this bypass circuit, and overcharge of a rechargeable battery is prevented.

[0038] The conceptual diagram of the pressure-up actuation in said secondary power source 40 is shown in drawing 3 . In order to make the clock circuit 70 drive, now, the electrical potential difference of at least 1 volt is needed. Unlike the common cell, the rechargeable battery 42 which stores the electrical and electric equipment has the property that an electrical potential difference changes according to a charge. If a charge falls and an electrical potential difference is less than 1 volt, since the energy itself has the insufficient electrical potential difference of a certain thing, a clock will stop. In order to make it start and to continue moving a clock for a long time early if possible, it is necessary to use without futility the energy which charged the rechargeable battery 42. Then, the pressure up of the electrical potential difference of the low condition of a rechargeable battery 42 was carried out using the booster circuit 44 to the electrical potential difference of level required for making a clock drive, and it has charged to the capacitor 46.

[0039] The booster circuit 44 of an example continues and carries out the pressure up of this to seven 1 time [3 times to] as many steps as this, and it passes and it charges the auxiliary capacitor 46 so that the electrical potential difference may become more than 1V, as are shown in drawing 3 and the electrical potential difference of a rechargeable battery 42 increases by charge. Similarly, when the

electrical potential difference of a rechargeable battery 42 declines by discharge etc., contrary to the case of a pressure up, the pressure up of this electrical potential difference was carried out over seven steps within the limits of 1 time to 3 times, and it has charged to the auxiliary capacitor 46.

[0040] Moreover, it is necessary to tell a user about how much [after] it continue moving in such an electronic clock. For this reason, as for the electronic clock of an example, the current charge of a rechargeable battery 42, i.e., the indicator ability to which a clock expresses the residue of how much [after] to continue moving, is prepared.

[0041] For [for this] residue detection, the electrical-potential-difference detecting element 60 which detects the electrical potential difference of a rechargeable battery 42, and the residue detecting element 62 which detects the residue of a rechargeable battery 42 based on this detection electrical potential difference are formed in the equipment of an example, and it is constituted so that a residue detecting signal may be outputted towards the clock circuit 70.

[0042] As shown in drawing 5 , by pushing the carbon button 92 at the upper right of RYUZU, the clock circuit 70 fast forwards the second hand under movement, and it is formed and it is so that the residue display of a rechargeable battery 42 may be performed in the amount of rapid traverses. That is, when there are three days or more of residues of a rechargeable battery 42, for 30 seconds, the 2nd day or more, in a certain case, in a certain case, the second hand will be fast forwarded like 5 seconds for 10 seconds one day or more for 20 seconds for 3 hours or more in a certain case, and the residue display will be performed. Moreover, when a residue is less than 3 hours, it also has the device in which the second hand turns into movement for 2 seconds.

[0043] And when the residue of a rechargeable battery 42 runs short, a user performs boosting-charge actuation to a rechargeable battery 42, looking at an indicator display as shown in drawing 5 so that the charge of a rechargeable battery 42 may turn into a predetermined basis, for example, the charge of the part on the 1st. If the electronic clock of this example which adopted the generation-of-electrical-energy means as shown in drawing 2 has such boosting-charge actuation, it performs the body of a clock by rotating a swing and the rotation spindle 12.

[0044] Such residue detection of a rechargeable battery 42 is performed based on the charge electrical potential difference of the rechargeable battery 42 usually detected by the electrical-potential-difference detecting element 60. When the rechargeable battery 42 consists of capacitors etc., as for such detection technique, it is satisfactory, but when it is the rechargeable battery which used the conductive polymer for the electrode, it cannot perform exact residue detection.

[0045] This example is characterized by performing the residue detection correctly, when a rechargeable battery 42 is such a polymer battery.

[0046] The boosting-charge property of the polymer battery 42 used as a rechargeable battery is shown in the electronic clock of an example at drawing 4 . As this polymer battery, various kinds of things are known, for example, there are the poly acene cell, a Li/PAS cell, a PAS-Li composite / PAS cell, a PAS/PAS cell, etc.

[0047] If this kind of rechargeable battery 42 performs boosting charge, terminal voltage will appear greatly from an actual charge. Moreover, when the charge energy of a rechargeable battery is consumed, the terminal voltage has the inclination to fall rapidly to the electrical potential difference corresponding to a true charge. Therefore, at the time of boosting charge, the phenomenon in which the terminal voltage is unsteady up and down occurs.

[0048] The residue detecting element 62 has set up four reference voltages, Va, Vb, Vc, and Vd, corresponding to four residue displays of (A) - (D) of drawing 5 .

[0049] By the conventional residue detection technique, since it judged that it charged to the setting charge and an indicator display was performed when a detection electrical potential difference exceeds this reference voltage, an exact residue display was not completed.

[0050] On the other hand, when a detection electrical potential difference carries out predetermined conventional-time continuation and exceeds reference voltage, the residue detecting element 62 of an

example judges that the rechargeable battery 42 was charged to the charge corresponding to the reference voltage, and it is constituted so that a residue detecting signal may be outputted.
[0051] For example, if boosting-charge actuation is performed when the residue of a rechargeable battery 42 becomes about zero, it is the detection electrical potential difference Vi of a rechargeable battery 42. As shown in drawing 4 , it is the 1st reference voltage Va. Exceeding first is t1. It is timing. However, in this condition, an electrical potential difference Vi is reference voltage Va immediately after that. Since it is less, it is judged that charge for 3 hour is not performed. And detection electrical potential difference Vi Reference voltage Va Fixed conventional time ta It is t3 the time of having exceeded continuously in between being detected. A residue detecting signal is outputted for the first time. Thus, the residue concerned will be displayed on an indicator in the phase where it was checked that the predetermined charge had been charged certainly. Consequently, a user becomes possible [performing boosting charge], trusting the display of an indicator.
[0052] Said conventional time is the value ta of a proper, tb, tc, and td for every reference voltages Va, Vb, Vc, and Vd at this example, respectively, although all may be set [as opposed to / at this time / each reference voltage] up identically. It has set up. This becomes possible to perform more positive residue detection according to the charge level of a rechargeable battery.
[0053] Charging efficiency gets worse, so that especially the electrical potential difference at the time of charge of a polymer battery turns into a high electrical potential difference. For this reason, as for said conventional time, it is desirable to set up the conventional time by the side of the high voltage for a long time.
[0054] For this reason, in an example, said each conventional time is set up as follows.
ta = 10-second tb = 20-second tc = 40-second td = -- in addition, drawing 4 is drawn typically for explaining the principle of this invention generally for 60 seconds. Therefore, actual t3 -t4, t6 -t7, and t8 -t9 Spacing becomes long enough rather than it is shown in drawing.
[0055] The 2nd suitable example of the electronic clock of this invention is shown in 2nd example drawing 6 . In addition, the same sign is given to said 1st example and a corresponding member, and the explanation is omitted.
[0056] In the electronic clock of this example, the charge isolating switch 64 is formed in the charge circuit turned to the rechargeable battery 42 from the magneto coil 22. And when the residue detecting element 62 performs residue detection of a rechargeable battery 42, only a predetermined short time turns off a switch 64 and charge of a rechargeable battery 42 is stopped compulsorily.
[0057] Detection electrical potential difference Vi of the rechargeable battery 42 detected by the electrical-potential-difference detecting element 60 at this time It changes, as shown in drawing 7 . Namely, it is ta at the time of boosting charge. If a switch 64 is turned off to timing and charge is stopped, it is the terminal voltage Vi of a rechargeable battery 42. Attenuation is started towards the stabilization electrical potential difference corresponding to a true charge.
[0058] It can be judged that there are few actual charges, so that the sag after fixed time amount progress is large as a property of a polymer battery, after suspending charge.
[0059] the damping property and the detection electrical potential difference Vi of such [the residue detecting element 62] a rechargeable battery 42 from -- the stabilization electrical potential difference of the rechargeable battery corresponding to a charge -- a presumed operation -- carrying out -- this -- each reference voltage Va-Vd It compares. And when the electrical potential difference by which the presumed operation was carried out exceeds one of reference voltages, the residue detecting signal corresponding to the reference voltage concerned is turned and outputted to the clock circuit 70.
[0060] thus, also by carrying out, residue detection at the time of the boosting charge of a polymer battery 42 can be performed correctly.
[0061] The 3rd suitable example of the electronic clock of this invention is shown in 3rd example drawing 8 .
[0062] In the electronic clock of an example, the ammeter 66 which detects the charging current is

formed in the charge circuit turned to the rechargeable battery 42 from the magneto coil 22, and the detection value is outputted towards the residue detecting element 62.
[0063] The residue detecting element 62 calculates the charge energy to a rechargeable battery 42 based on the detected charging current and the charging time. and the detection electrical potential difference amended by carrying out the amendment operation of the detection electrical potential difference based on charge energy -- said 2nd example -- the same -- each -- reference voltage Va - Vd It compares. And when an amendment detection electrical potential difference exceeds one of reference voltages, the detecting signal of the corresponding residue is turned and outputted to the clock circuit 70.
[0064] Thus, the residue operation part 62 of an example amends a gone up part of the detection electrical potential difference of a rechargeable battery 42 from the calculated charge energy, and is carrying out the presumed operation of the electrical potential difference corresponding to a charge. thus, also by carrying out, the residue display at the time of the boosting charge of a polymer battery 42 can be performed correctly.
[0065] Moreover, a charge electrical potential difference can be presumed from the charge energy which can be found from the charging current and the charging time, without using said electrical-potential-difference detecting element 62 by table-izing the correlation of charge energy and an electrical potential difference beforehand, and memorizing to the residue operation part 62.
[0066] In addition, this invention is not limited to said each example, and various kinds of deformation implementation by within the limits of the summary of this invention is possible for it.
[0067] For example, although said each example explained taking the case of the thing using a generator 16 and the rotation spindle 12 as shown in drawing 2 as a generation-of-electrical-energy means, it cannot be overemphasized that this invention can be applied also to the electronic clock not only using this but various kinds of generation-of-electrical-energy means, for example, a solar battery etc., etc.
[0068] Moreover, although said example explained as an indicator which indicates by the residue taking the case of the case where the second hand for analog displays is used, this invention may be made to indicate on a liquid crystal display in addition to this by the residue in an electronic clock liquid crystal display type [for example,].
[0069] Moreover, if needed, IC for voice outputs may be prepared and the voice output of the residue may be carried out.
[0070] Moreover, although said example explained this invention taking the case of the case where it applies to a wrist watch, it cannot be overemphasized that this invention can be applied to various clocks not only this but other than this, for example, a portable clock etc.
[0071]
[Effect of the Invention] As explained above, when carrying out boosting charge of the rechargeable battery which used the conductive polymer for the electrode according to this invention, the electronic clock about which can detect the residue of a rechargeable battery correctly and a user can be told, and its residue detection approach can be offered.

[Translation done.]

2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the circuit diagram of the 1st example of the electronic clock of this invention.
[Drawing 2] It is the explanatory view showing the important section of the mechanical configuration of the electronic clock of an example.
[Drawing 3] It is the explanatory view showing actuation of the booster circuit of the electronic clock of an example.
[Drawing 4] It is the explanatory view of the charge property at the time of the boosting charge of the rechargeable battery which used the conductive polymer for the electrode.
[Drawing 5] It is the explanatory view of the example of a residue display.
[Drawing 6] It is the circuit diagram of the 2nd example of the electronic clock of this invention.
[Drawing 7] It is the approximate account Fig. of the principle of residue detection of the electronic clock concerning the 2nd example.
[Drawing 8] It is the circuit diagram of the electronic clock concerning the 3rd example of this invention.
[Description of Notations]
10 Generation-of-Electrical-Energy Means
40 Secondary Power Source
42 Rechargeable Battery
44 Booster Circuit
46 Auxiliary Capacitor
60 Electrical-Potential-Difference Detecting Element
62 Residue Detecting Element
66 Ammeter
70 Clock Circuit

[Translation done.]

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[Claim(s)]
[Claim 1] A generation-of-electrical-energy means to output the electrical energy for charge,
The secondary power source charged by said electrical energy for charge,
The clock circuit which operates using the charge energy of said secondary power source,
An electrical-potential-difference detection means to detect the electrical potential difference of said secondary power source,
A residue detection means to perform residue detection of said secondary power source based on the detection electrical potential difference detected with said electrical-potential-difference detection means,
In the electronic clock which tells the detection residue detected with the implication and said residue detection means, and demands charge of a secondary power source from a user,
Said secondary power source,
The rechargeable battery which used the conductive polymer for the electrode is included,
Said residue detection means,
The electronic clock characterized by being formed so that the detecting signal of the residue of said rechargeable battery corresponding to said reference voltage may be outputted when the reference voltage corresponding to the residue of said rechargeable battery was set up beforehand, and said detection electrical potential difference carries out predetermined conventional-time continuation and exceeds said reference voltage.
[Claim 2] In claim 1,
Said residue detection means,
The electronic clock characterized by outputting the detecting signal of the residue of said rechargeable battery corresponding to said reference voltage when two or more reference voltages which were equivalent to the residue of said rechargeable battery beforehand were set up, and said detection electrical potential difference carries out predetermined conventional-time continuation and exceeds said predetermined reference voltage.
[Claim 3] In claim 2,
Said residue detection means,
The electronic clock characterized by setting up said conventional time for every aforementioned reference voltage.
[Claim 4] A generation-of-electrical-energy means to output the electrical energy for charge,

The secondary power source charged by said electrical energy for charge,
The clock circuit which operates using the charge energy of said secondary power source,
An electrical-potential-difference detection means to detect the electrical potential difference of said secondary power source,
A residue detection means to perform residue detection of said secondary power source based on the detection electrical potential difference detected with said electrical-potential-difference detection means,
In the electronic clock which tells the detection residue detected with the implication and said residue detection means, and demands charge of a secondary power source from a user,
The charge cutoff switching means which stops the charge to said secondary power source from said generation-of-electrical-energy means is included,
Said secondary power source,
The rechargeable battery which used the conductive polymer for the electrode is included,
Said residue detection means,
The electronic clock characterized by being formed so that charge of said secondary power source may be temporarily suspended by said switching means, the residue of said rechargeable battery may be detected based on the damping property of said detection electrical potential difference at this time and the detecting signal of a residue may be outputted.
[Claim 5] A generation-of-electrical-energy means to output the electrical energy for charge,
The secondary power source charged by said electrical energy for charge,
The clock circuit which operates using the charge energy of said secondary power source,
An electrical-potential-difference detection means to detect the electrical potential difference of said secondary power source,
A residue detection means to perform residue detection of said secondary power source based on the detection electrical potential difference detected with said electrical-potential-difference detection means,
In the electronic clock which tells the detection residue detected with the implication and said residue detection means, and demands charge of said secondary power source from a user,
A current detection means to detect the charging current from said generation-of-electrical-energy means to said secondary power source is included,
Said secondary power source,
The rechargeable battery which used the conductive polymer for the electrode is included,
Said residue detection means,
The electronic clock characterized by being formed so that the charge energy to said rechargeable battery may be calculated based on said charging current and charging time, the residue of said rechargeable battery may be detected based on this charge energy and the detecting signal of a residue may be outputted.
[Claim 6] In the approach of detecting the residue of said rechargeable battery in case boosting charge of the rechargeable battery which used the conductive polymer is carried out to an electrode using a charge means,
The process which detects the electrical potential difference of said rechargeable battery,
The process which sets up two or more reference voltages which were equivalent to the residue of said rechargeable battery beforehand, and detects the residue corresponding to said reference voltage as a residue of a rechargeable battery when the detected electrical potential difference carries out predetermined conventional-time continuation and exceeds said reference voltage,
****** -- the residue detection approach of the rechargeable battery in the electronic clock characterized by things.

[Translation done.]